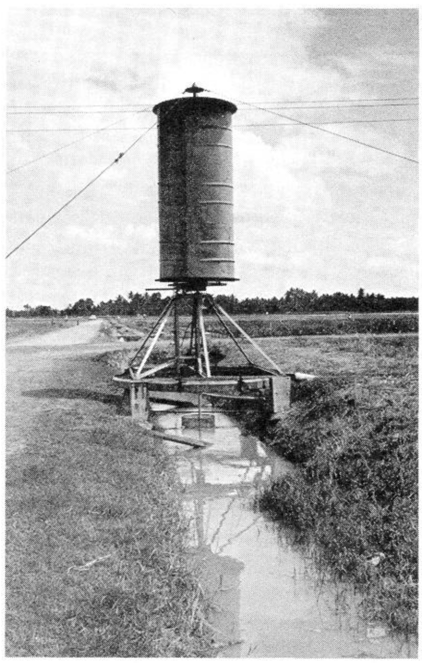
Making the most of Asia's small farms

Edward J. Weber

Millions of Asian families earn their livelihood and sustenance from small plots of land on which they cultivate their staple food, rice. As populations grow, however, greater pressure is being put on these people and their land to produce sufficient food just to feed themselves, with very little left over.

Multiple cropping is one way of intensifying production from the same land and it has been practiced and refined by farmers in many locations for centuries. It has only been recently, however, that these intensive multiple cropping systems, often considered "subsistence" as opposed to more "modern" commercial or cash crop techniques, have begun to receive serious attention from the scientific community concerned with improving agricultural production and thereby, rural welfare. Since its inception, the IDRC has been actively involved in this kind of work and one of the first and largest continuing programs receiving IDRC backing is at the International Rice Research Institute (IRRI) in the Philippines.

The Institute has been directly involved in some form of multiple cropping research since 1968, with the objectives of developing intensive diversified systems of food crop production that could maximize the use of land, solar radiation and water. This program was reorganized and intensified in 1972 when the IDRC assumed major financial support for it in conjunction with a related extension-oriented multiple cropping research project at the University of the Philippines Los Banos College of Agriculture close by. These cooperative efforts have now been expanded and linked into a still growing Southeast Asia regional network of research projects concerned with making biological research results more relevant and applicable to the needs and methods of the small Asian farmer.



An experimental windmill water pump at IRRI — but most farmers must depend on rainfall.

Multiple cropping or cropping systems research in this network is aimed at the more efficient use of resources that are available to the small farmer. The research approach being used at IRRI and in the associated projects of the network is first to come to an understanding of the existing systems operated by farmers before trying to determine what changes should be made. This is particularly important with traditional cropping systems since the components in these systems are so interdependent. In the past, much of the so-called "Green Revolution" technology failed to meet expectations for rapid spread among small farmers over wide areas because these interdependencies were not sufficiently considered, and the new technology was more adapted to ideal conditions than to the constraint-ridden situation of most small farmers.

Small Asian farms are, for the most part, characterized by a diversity of crop, animal and off-farm activities all of which contribute to the cash flow of the farming system. It has been normal practice for scientists developing agricultural production technology to pay attention only to the field areas where major crops are grown. However, there is often an additional homestead production area surrounding the house or farmyard where the farm family lives. This area is normally planted to a wide assortment of crops that contribute diversity and quality to the family's diet. The relative importance of this area to the family depends on both farm size and its cash flow, but for a low-income subsistence farmer the homestead is as important as his cultivated field area.

A great majority of the small farms in East and Southeast Asia depend on rainfall and only partially on irrigation to supply the water needed to grow their rice crop. In most instances only one crop is harvested even where partial irrigation is available. It is these areas that offer considerable potential for increased production through intensive cropping and thus form the major focus of IRRI cropping systems research. In most years two crops of rice, or at least rice followed by an upland crop, are possible if new procedures can be introduced.

Normally farmers wait until the monsoon rains have deposited enough water on their fields so they can puddle the soil and transplant young rice seedlings into the resulting water saturated mud. With new early-maturing rice varieties, however, it is possible to plant rice seed directly into non-puddled soil at the start of the rains in regions where the monsoon starts gradually. Direct seeding eliminates the traditional long wait until the monsoon is well established then puddling and transplanting which can use up to five months of good rainfall for a single rice crop. The new method permits

Photos: Neill McKee

The traditional method of transplanting of rice seedlings must wait for the arrival of monsoon rains.

growing two short season rice crops during the rainy period, since the first one can be harvested soon enough to allow time for a second to be transplanted in the normal fashion.

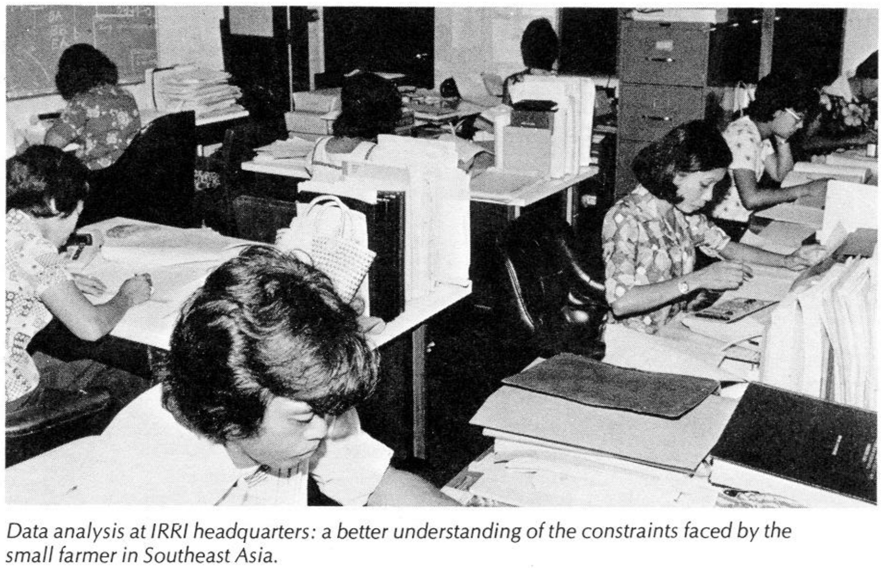
Where the rains begin suddenly rather than gradually, direct seeding is not possible and transplanted puddle rice must be grown. In many areas, however, there is still enough moisture available after the rice has been harvested to plant another crop such as a vegetable or various kinds of legumes. The potential number of combinations of crops, crop varieties, economic factors and climatological and physical characteristics that could be considered is mind boggling, but it is the task of the cropping systems research program to sort these out and come up with potentially more productive crop combinations or patterns than those farmers are presently using. The methodology being developed to do this is novel and interesting in itself.

Since the physical conditions under which small farmers grow their crops vary so greatly from place to place throughout the Southeast Asian region where this cropping system program is concentrated, IRRI scientists began by organizing an agroclimatic study in the region to define the physical basis for various cropping patterns. More specific studies in the Philippines, Bangladesh, Sri Lanka, Thailand, and Indonesia were undertaken later as part of specific associated country programs. Information on soils, rainfall, solar radiation, temperature variation, topography, water supply, and other factors was gathered and compiled to delineate agro-climatic zones where particular combinations of crops and cropping practices would most likely be successful. IRRI has coordinated these mapping and data gathering efforts on a region-wide basis to permit the selection of research sites in key zones, the extrapolation of results across zones, and the application of local research data to similar zones elsewhere in the region.

Agroclimatic surveys were just the start. Much more information was needed on small farms and on the farmers themselves as well as a means of more quickly determining whether research results they were obtaining would be useful to the farmers or not. A four-step approach has evolved through experimentation, and a good deal of time spent in farmers' fields, by the scientists who are attempting to develop appropriate technological packages which can improve the production and thereby the well-being of farm people.

The first step is to observe and describe the environment as well as the farmers' operational systems and constraints in fairly precise terms. Economic factors are especially important here as they relate to the supply of farm labour over the year, markets, cash flow, farm size, cost and availability of animal or mechanical power for land tillage, etc. The gathering of this information and relating it to the requirements of potentially more intensive cropping patterns leads to a better understanding of the constraints faced by the farmer under his particular conditions.

Armed with this information, the researcher can then move on to the second step, the design phase, in which he attempts to put together improved cropping patterns to make more effi-



Data analysis at IRRI headquarters: a better understanding of the constraints faced by the small farmer in Southeast Asia.

cient use of the farmers' available physical and other resources. In order to do this, he must have a source of improved component technologies such as better plant varieties, pest and weed management recommendations, new crops, etc. Potentially feasible cropping patterns are matched with socio-economic resource requirements to make sure that there are no bottlenecks which the farmer will not be able to overcome. A number of alternative cropping patterns from which the farmer can choose are likely to be necessary.

Once potentially improved systems are designed comes the third step: they must be tested out in the environment for which they are intended. They must be taken to farmers' fields where they can be observed not only in the exact physical environment where they may be used but also under the management constraints that the farmer himself faces. This is a very important part of the cropping systems research approach which can best be illustrated in more detail by an example.

Approximately 50 farmers from four villages agreed to grow one or two potential new cropping patterns in addition to their own crops. Each pattern was to occupy an area large enough so that realistic labour and power used for cultivation data could be collected. It was carefully explained to the farmers that they were part of a research program and that nothing was being extended or demonstrated. All methods and practices were reviewed by the farmers before planting. They were encouraged to choose the crop patterns they wanted to try from the list of possibilities provided by the scientists. This participation in research intrigued the farmers, many of whom made their own suggestions for im-

Under the palms a healthy sorghum crop follows the traditional rice crop.

provements or changes — for example, the farmers insisted that the row spacings based on research station findings were too wide and would make weed control difficult. Incentives in the form of seed, fertilizers, and insecticides were given, but only as called for in the experimental outline. The farmers agreed to provide all power and labour and to harvest the crops in the same way they would their own. No crop guarantee was given. The farmers assumed all risks involved. Each farmer was also asked to keep a daily record on a form provided to him on what he did to the field and how long it took. In the end the harvest went back to the farmer after yield measurements and other experimental data were recorded.

The fourth step in this integrated applied approach to cropping pattern development is extension. Involving extension workers in the research program early on can minimize the problems of interagency transfer of results and information later. Having been involved in the development of cropping pattern recommendations and having seen farmer reactions to them in the early stages, extension agents will be better able to understand and explain these patterns to farmers who are potential adopters. This linkage also leads to rapid feedback of problems in the field to researchers and planners in a responsive system whereby each season's experiences are translated into next season's research and project redesign.

IRRI has done considerable work on developing cropping systems research methodology, but its main focus must be on providing the component technology of improved plant material and agronomic practices for potential systems which can be adapted in national programs. To encourage local adaptation of these results, the IDRC has provided support for a number of national cropping systems research programs which are now deeply involved in developing and adapting cropping patterns and systems for regions in their own countries. Support has been provided for programs in Sri Lanka, Bangladesh, Thailand, Indonesia and the Philippines, oriented to the specific needs of these countries but linked closely to IRRI. In addition, a project was funded at the University of the Philippines to screen a large number of varieties of upland crops used in cropping patterns and then sending the most promising of these to the other country programs for local adaptation trials and incorporation into potentially more productive cropping patterns.

In order to coordinate the work in all the country programs and that of IRRI, a working group has been formed of the program leaders from each of the country programs. This working group meets twice a year to exchange information on research results, discuss future plans, exchange experiences and examine new ideas. Such meetings provide opportunities for country program representatives to learn from each other in a way that would not be possible if their only links were with IRRI personnel.

A good deal of progress has been made in multiple cropping systems research over the past five years but much still remains to be done. An important concern, however, is to make the whole program a regional one in which national programs are equal participants in developing the required technology while cooperating with IRRI which is acting as the hub of the network. □

Field testing the improved systems under farm conditions — the farmer and his wife manage the system themselves, take all the risks and reap the benefits.

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